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GSM BASED FIRE SECURITY USING ARDUINO

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ABSTRACT

Outbreak of fire can create a mass impact on human lives as well as their belongings. In our country, as fire breaks out, people count tremendous amount of losses. Here, the traditional process of firefighting is very time consuming and less effective. To put down this problem, we developed a device which can provide the maximum security when fire breaks out. The device we developed is so fast and more effective than traditional process. The recent technology available in the market for fire security has less success rate than the device we developed. This device comes with some unique features. These are as follows- 1) Detects Fire or any burning Smoke. 2) Detects Gas leakage. 3) Detects high Temperature. 4) A LCD shows all the device related messages on the display. 5) Cuts the electricity automatically as the fire breaks out. 6) The device uses its own back-up power when fire breaks out. 7) As the device detects any deformity on that surrounded area, owner gets an Alert SMS. 8) Rings the Buzzer & blinks the LED when any deformity detected. 9) As fire breaks out, all Fire Exits, Doors and Windows will open automatically. 10) The water sprinkler will sprinkle water on the affected area. 11) This device also sends an Alert SMS to the nearest Fire and Civil Defense office with the area address. These precautions and actions are enough to stop an upcoming or ongoing fire disaster.

INTRODUCTION

Bangladesh is a developing country but one unfortunate event can make a huge difference. Outbreak of fire in any industrial or residential area, can lead to a tragic situation. This kind of event actually slows the development speed of a country. We were concerned about the implementation of this device at the crucial circumstance. For instance, The 2012 Dhaka Fire at Tazreen Fashion factory. A fire broke out and about 117 people were confirmed dead and total 200 were injured. So, the main objective of this project is to construct a device, which can provide fire security in industrial and residential area. The device we built is very effective and time consuming compared to other traditional fire security systems. This device is a complete solution for fire related security and comes with some unique features. For this reason, this device is totally different from other fire security systems. The most important equipment of this fire security system is GSM technology and Arduino. Now the question is, what's the purpose of these two equipment on this project? GSM (Global System for Mobile communication) is a digital mobile telephony system. We are using this technology for sending Alert Messages to owner and Bangladesh Fire Service & Civil Defense office. We are using an android application and an android device for sending these Alert Messages. The device we developed is directly connected with an android device through a Bluetooth module and an android application called 'Arduino SMS'. This application comes with a default code. But we developed a new code for our system. Every operations and actions of this system are controlled by Arduino. Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are basically designed for reading inputs - light on a sensor, a finger on a button, or a text message - and turn it into an output - driving a motor, turning on an LED, publishing something online, sending text messages. One can drive the board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language, and the Arduino Software (IDE), based on Processing.

The rest of the paper is organized as follows: Section II includes the block diagram and simulation results of this project. The detailed explanation of this project is summarized in section III. Future works of this project are described in Section IV. The paper is concluded in section VI.

PROPOSED DESIGN & SIMULATION

A. Block Diagram of achieving goal

The complete block diagram of this project will be shown throughout this section

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Figure 1: Block diagram of proposed design

Here, figure 1 show that, Arduino is taking outputs from sensors. Then it processes those reading from sensors and takes necessary steps. We can understand this through the blocks in the right side. LCD display shows the system related messages and GSM technology is been used to send alert messages.
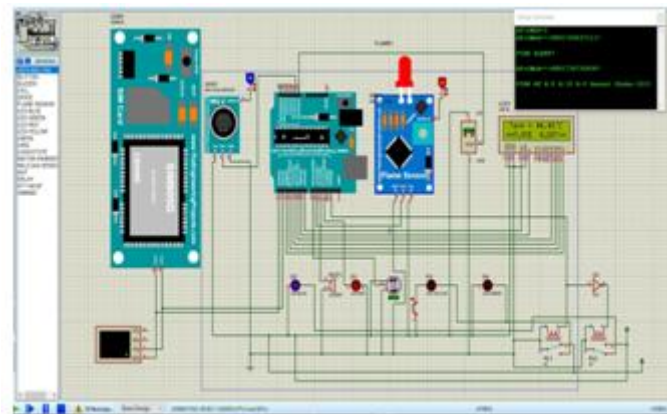
B. Simulation Results

The Proteus Design Suite is an appropriate software tool for electronic design automation. We used Proteus 8 Professional to simulate our work.

Figure 2 is showing the complete simulation of our project. Therefore LCD is displaying "FIRE SECURITY". In this image the red box on the bottom right side is actually showing the BACKUP POWER MECHANISM of this project. The state shown in figure 3 is fire breakout state. The alert mechanism of this mode is almost same as gas leakage state. But the differences are as follows-

In this state, system sends two different text messages. One is for owner's phone and another is for local fire brigade office along with the area address. In the virtual terminal it can be seen that, the system actually sending two messages in two different numbers. Green LED will stop glowing in this state. This the state where backup power mechanism generally activates. Two relays are used to design this mechanism. The design of this mechanism is almost same as UPS system.

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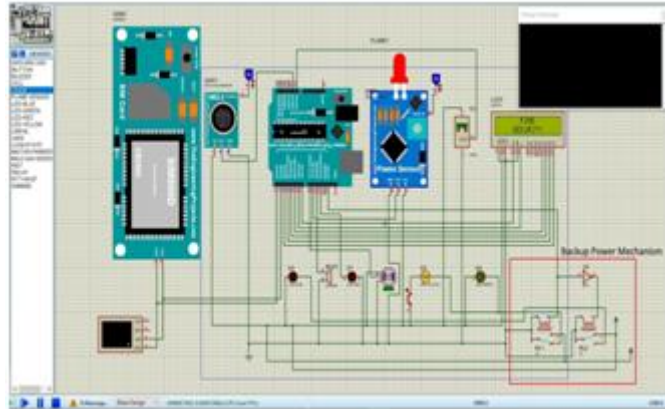
Figure 2: Initial state in design suit

Figure 3: Fire breakout state in design suit

Here, the principles of relay are to cut the internal electricity and activate the backup power for driving the whole system. There is another feature of this state, when fire breaks out a water sprinkler will start to sprinkle water over the affected area. To show this mechanism a blue LED is used in the design suit. The blue LED glows only when the fire breaks out. Therefore, LCD display is showing "FLAME ALEERT" message.

PROJECT DETAILS
In this part, how does the fire and other problem will be detected and necessary actions will be taken are shown through a proposed model. The model summarizes the complete work of our project. It will be very easy to understand the contexts of this device through that figure

Here, we are using three different sensors. These sensors actually detect any kind of problem which may lead to a fire breakout situation or any outbreak of fire on that area. From these three sensors one is Temperature sensor, one is Gas sensor and another one is Flame sensor.
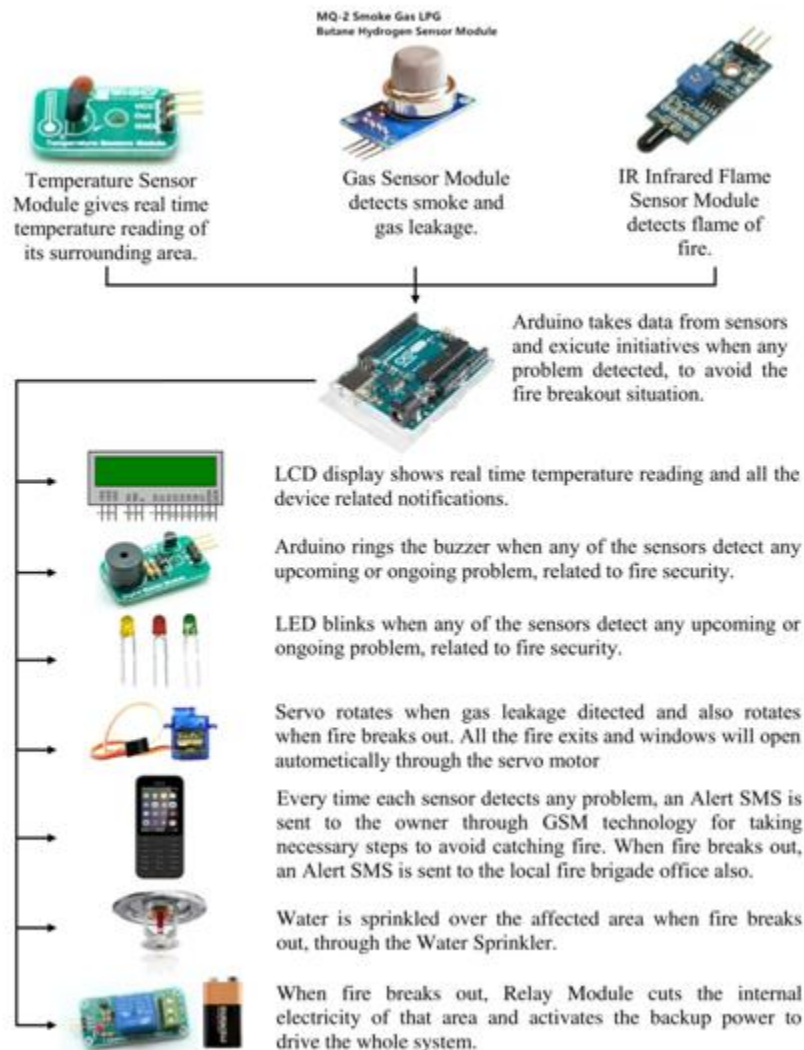
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Figure 4: Complete model of this project

A. Hazard Detection Process

In this device, sensors are used to detect any upcoming or ongoing hazards. The hazard detection processes are as follows-

- **Temperature Sensor:** We are using LM35 temperature sensor module to detect any excessive rate of temperature. Sudden temperature rise can be the reason for catching fire.
- **Gas Sensor:** This security system includes MQ2 gas sensor module. This sensor can detect flammable gas like, Liquefied Petroleum Gas (LPG), I-Butane (C_4H_{10}), Propane (C_3H_8), Methane (CH_4), Alcohol (−OH), Hydrogen (H_2) and Smoke (CO_2). This module comes with high sensitivity and fast response time. The module has a potentiometer for adjusting the sensitivity.
- **Flame Sensor:** In this System, IR flame sensor has been used to detect fire flame. The IR flame sensor is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED.

B. Resolution Process

The main target of this device is to provide necessary initiatives as any of these hazards detected or when fire breaks out. The resolution process of this device is so effective and time consuming. The resolution this device performs are explained below-

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- **High Temperature Alert:** This device can measure its own surrounding temperature through LM35 temperature sensor. LCD display shows the temperature measurement all the time. The system actually detects the high temperature. When temperature exceeds 45 degree Celsius, Red LED will start to blink and buzzer will ring. Therefore, LCD display will show "HIGH TEMP" message along with the temperature reading and an alert message will be sent to the Owner's phone to take necessary steps as soon as possible. Here, we are using GSM technology for sending this alert message. The system will send an alert message through an android device by using an android application called 'Arduino SMS'. To drive this application the system needs to be connected through a Bluetooth module with the android device. This application comes with a default code. But we developed a new code for our system. As our system is GSM based, so we are actually using GSM technology here.

- **Gas Leakage Alert:** The alert mechanism of gas leaking is slightly different from high temperature alert. Here, servo rotes 90 degree. That means, when the system detects any gas leakage, windows and doors will open automatically to reduce the risk of catching fire. When system detects any gas leakage, LCD display will show "GAS ALERT" message.

- **Flame Alert:** The alert mechanism for this state is also same as the previous state. But the differences are, system sends two different text messages. One is for owner's phone and another is for local fire brigade office along with the area address. There is another resolution for this state, when fire breaks out a water sprinkler will start to sprinkle water over the affected area. Therefore, LCD display will show "FLAME ALEERT" message.

- **Backup Power Mechanism:** In this project we developed a backup power system. The backup power mechanism generally activates when fire broke out. Two relays are used to design this mechanism. The design of this mechanism is almost same as UPS system. Here, the principle of relay is to cut the internal electricity and activate the backup power for driving the whole system.

FUTURE WORK

There is lots of scope in future regarding our developed security system. Further changes can be done for more effective and better output. We are proposing some future work related to our developed security system. A real time camera can be added with the device to confirm the reason of catching fire. GPS tracking device can be added to this system. If we add this device in our system then it will raise the working efficiency. Also, the action time will be less than before. Other house security systems can be merged with this device so that all the security system can be monitored from one single device. More high functioning sensors can be used to get maximum accuracy.

CONCLUSION

The system we developed is a complete solution for fire related security and comes with some unique features. GSM based fire security system can be used to save many lives and properties within a very short time. This system can be installed easily in house, garments, factories, office or in different institutes. The working principle of this system is very easy to understand. The unique feature of this device is, it comes with a backup power mechanism. The device we developed is so fast and more effective than traditional process. The recent technology available in the market for fire security has less success rate than the security system we developed.

REFERENCES

1. "At least 117 killed in fire at Bangladeshi clothing factory", www.cnn.com, 2012. [Online]. Available: [1] http://edition.cnn.com/2012/11/25/world/asia/bangladesh-factory-fire/?hpt=hp_t1. [Accessed: 08-Nov- 2017]
2. "Arduino Uno Rev3", Store.arduino.cc. [Online]. Available: https://store.arduino.cc/usa/arduino-uno-rev3. [Accessed: 05- Nov- 2017]
3. Proteus Design Suit. [Online]. Available: https://labcenter.s3.amazonaws.com/downloads/Tutorials.pdf. [Accessed: 09- Nov- 2017]